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HYDROCHEMICAL INVESTIGATION OF SOME VILLAGES IN SILWANI OF RAISEN DISTRICT (M.P.)

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Abstract

Water is required everywhere, without which neither the life nor any development is possible and thankfully much of the earth is made up of it. Yet we face major problems where the life sustaining liquid is concerned. While there is technically enough water available for all 7 billion of us, one fifth of world population live in areas of physical water scarcity. An adequate supply of safe drinking water is one of the major prerequisites for a healthy life. Drinking water is derived from two basic sources, surface water such as rivers, reservoirs and ground water. Ground water makes up about 20% of the world's fresh water supply which is about 0.61% of the entire world's water. Ground water is naturally replenished by surface water from precipitation, streams and rivers when this recharge reaches the water table. It can be a long term reservoir of the natural water cycle. All water contains natural contaminants particularly inorganic contaminants that arise from the geological strata through which the water flows and to varying extent anthropogenic pollution. In general groundwater is less vulnerable to pollution than surface water.

As ground water flows through sediments, metals such as iron and manganese are dissolved and may later be found in high concentration in the water. Human activities, agriculture, ground water pumpage and disposal of waste all can affect ground water quality. To provide safe drinking water to human being monitoring of water quality & quantity in surface & ground water resources is a necessary activity from time to time. The water pollution poses a serious threat to human being as well as to aqueous life.

Keyword:- Sustaining, Prerequisites, replenished, precipitation, contaminants, anthropogenic.

Introduction

In recent years the growth of industry technology, population and water use has increased the stress upon both our land and water resources. Municipal or Industrial waste, chemical fertilizer, herbicide and pesticide not properly contained have entered the soil, infilterated some acquifers and degraded the ground water quality.

Because water is an excellent solvent it can contain lots of dissolved chemicals. And since ground water moves through rocks & subsurface soils, it has a lot of opportunity to dissolve substances as it moves. For that reasons ground water will often have more dissolved substance than surface water will. Degradation of water quality erodes the availability of water for humans and ecosystems, increasing financial costs for human users, and decreasing species diversity and abundance of resident communities. These changes in environmental quality can be associated with changes in water quality parameters. Poor water quality can be the result of natural processes but is more often associated with human activities. The present investigation was carried out in the twenty villages of Silvani block of Raisen district. Different ions, iron, manganese, chromium, fluoride, chloride, sulphate are analysed before and after monsoon. Last year Bhopal & adjoining districts was blessed with good monsoon improving the water table. It raised not only the ground water level but also improving its quality. Although these metal ions are useful to human being for metabolic activity but gradual increase in the concentration of these element beyond permissible limit poses harmful effect to life. To mitigate the problem adequate information about the quality of water should be taken. Then only water quality degradation can be measured. If sufficient data are available, water treatment facilities can be performed accordingly.

Material & Methods

Groundwater samples were collected from twenty villages of Silwani in Raisen district. These water samples were collected in polythene bottles which had been thoroughly washed and filled with distilled water and then taken to the sampling site the bottles were emptied and rinsed several times with the water to be collected. The sample bottles were covered

immediately after collection. These water samples were analysed for Mn, Fe and Cr using atomic absorption spectroscopy as per the standard method given by APHA[1]. Fluoride, Chloride and Sulphate were also detected. All the reagent used were of A.R. Grade.

Result

In the present investigation Table I shows analytical parameter for TDS Metal Ions, Manganese, Iron & Chromium before and after monsoon. Table II shows the analytical parameters for Hardness, Fluoride, Chloride & Sulphate before and after monsoon. The result indicate there is good impact of heavy rain fall and the quality of water is improved[2,3]. The corresponding graph shows the result. The concentration of Iron, Manganese & Chromium is high than permissible limit in about 50% villages. Although WHO has raised the permissible limit of Iron concentration in drinking water.

Table No. 1:Analytical data for Physicochemical Parameter in Ground water of Block Silwani, Raisen District

S. No.	Name of Village	TDS		Mn		Fe		Cr	
		Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon
1.	Mahuakheda	784	736	0.72	0.64	0.85	0.68	0.065	0.059
2.	Jamanpani	852	824	0.85	0.72	1.54	1.25	0.070	0.064
3.	Simaria	696	630	0.55	0.46	1.46	1.17	0.055	0.048
4.	Ramgarh	934	856	0.42	0.38	1.73	1.46	0.046	0.038
5.	Narayanpur	844	816	0.78	0.68	1.75	1.57	0.062	0.058
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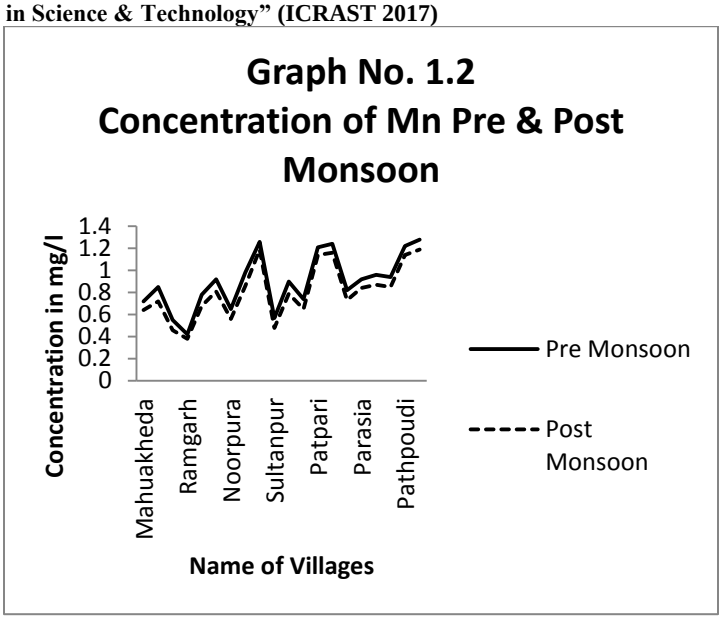
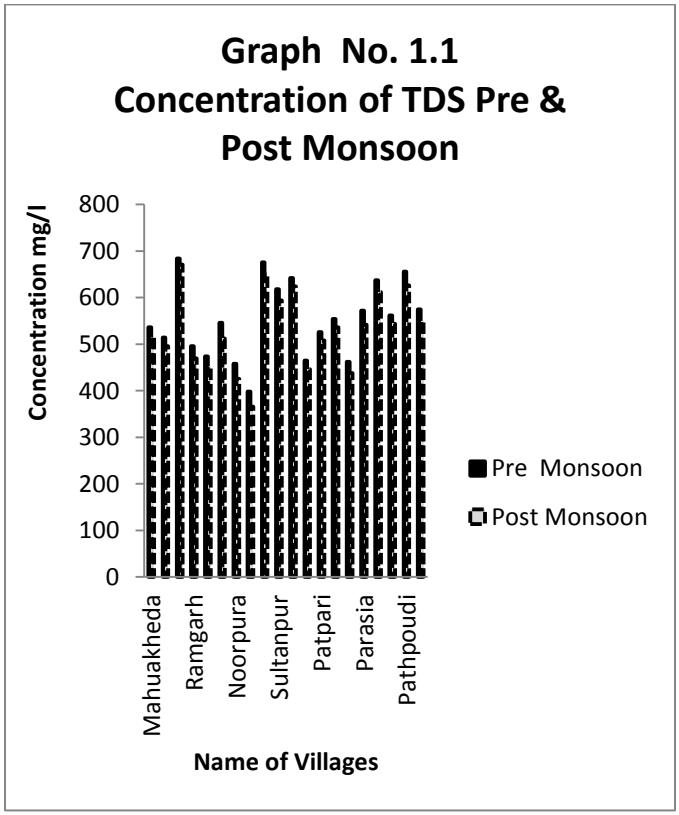
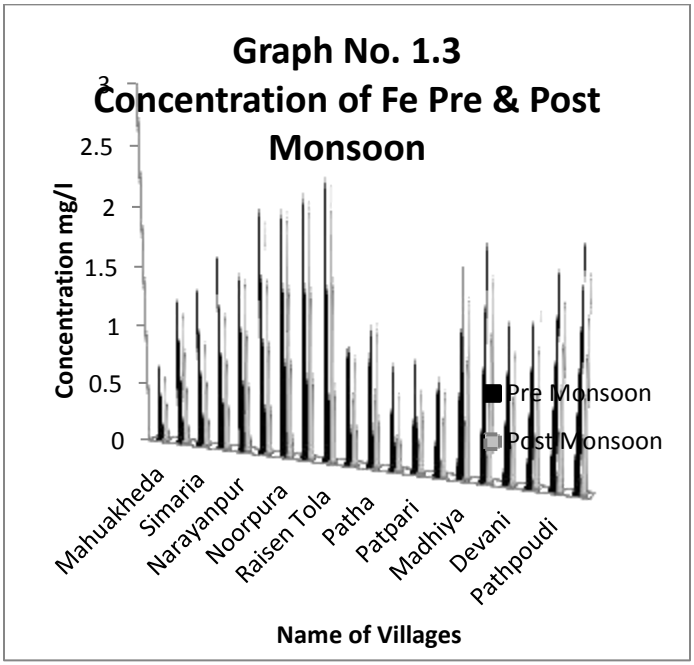
6.	Mehgawan	796	728	0.92	0.81	2.24	1.98	0.072	0.067
7.	Noorpura	814	782	0.65	0.56	2.32	2.08	0.042	0.037
8.	Jaithar ee	1026	968	0.98	0.86	2.56	2.14	0.082	0.076
9.	Raisen Tola	1124	1042	1.26	1.19	2.56	2.28	0.054	0.047
10	Sultanpur	876	734	0.57	0.48	1.36	1.07	0.044	0.038
11	Patha	778	716	0.90	0.79	1.45	1.26	0.038	0.032
12	Marhati	842	806	0.74	0.65	0.94	0.66	0.064	0.059
13	Patpari	685	628	1.21	1.14	1.05	0.86	0.052	0.048
14	Magrandi	756	714	1.24	1.16	1.02	0.78	0.060	0.057
15	Madhiya	768	726	0.82	0.73	1.72	1.55	0.045	0.039
16	Parasia	965	824	0.92	0.84	1.98	1.82	0.085	0.078

17	Devani	856	808	0.96	0.87	1.53	1.34	0.065	0.059
18	Samnapur	936	892	0.94	0.85	1.62	1.46	0.070	0.065
19	Pathpoudi	725	788	1.22	1.14	2.05	1.82	0.048	0.042
20	Paheria	835	796	1.28	1.19	2.17	1.93	0.058	0.053







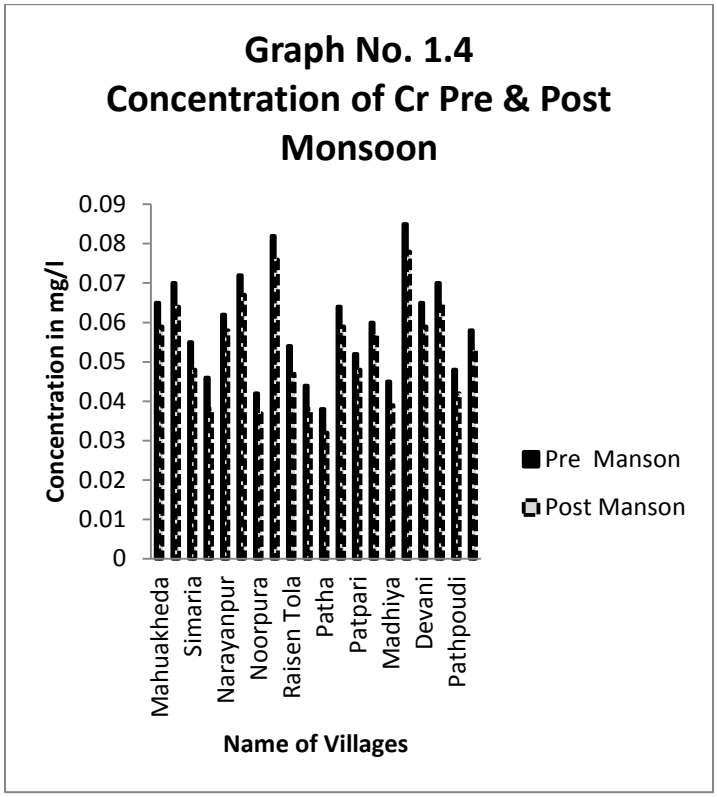
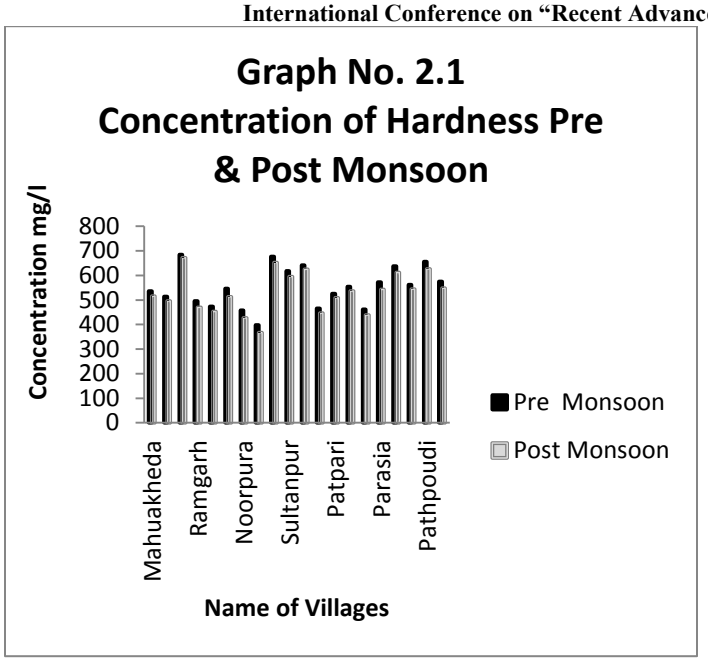
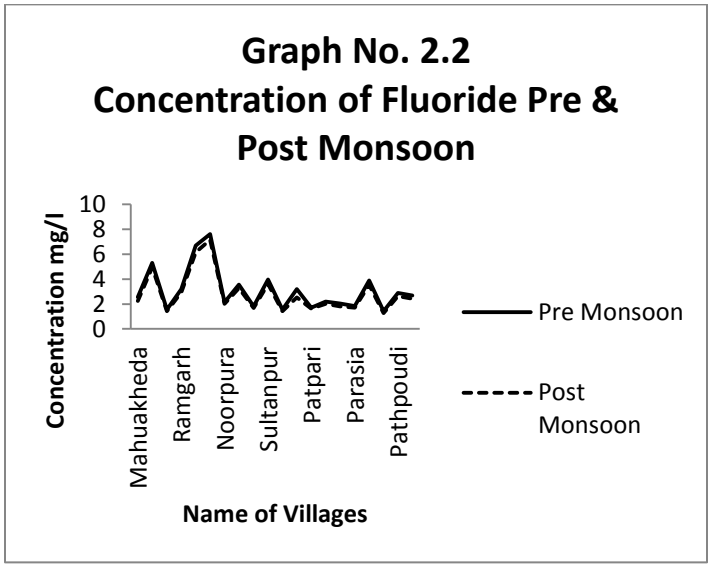
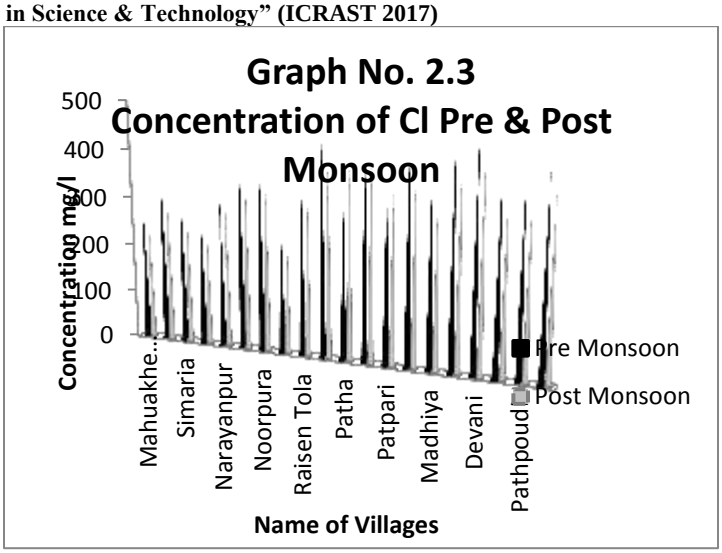


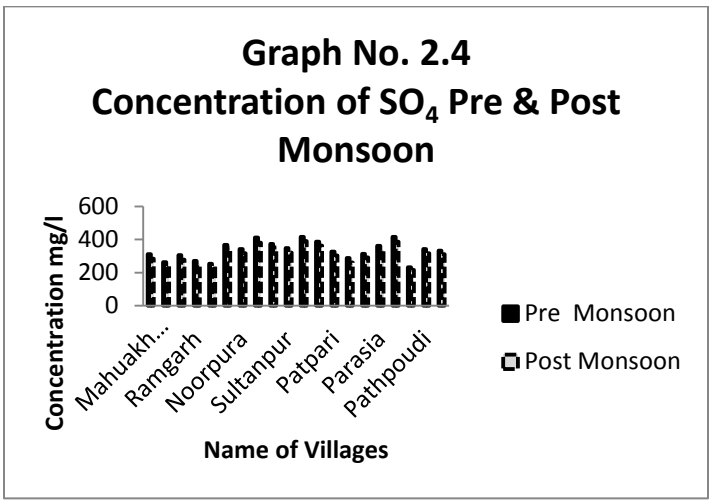
Table No. 2: Analytical data for Physicochemical Parameter in Ground water of Block Silwani, Raisen District

S. No.	Name of Village	Hardness		F		Cl		SO_4	
		Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon	Pre Monsoon	Post Monsoon
1.	Mahuakheda	536	515	2.56	2.25	278	248	312	285
2.	Jamanpani	514	496	5.30	4.95	362	328	264	240
3.	Simaria	684	671	1.55	1.42	315	286	306	278
4.	Ramgarh	496	470	3.20	2.95	294	270	272	250
5.	Narayanpur	474	452	6.70	6.15	304	288	254	236
6.	Mehgawan	546	512	7.62	7.16	415	378	368	348
7.	Noorpura	458	426	2.15	2.02	372	346	342	318
8.	Jaitharee	398	366	3.55	3.28	288	262	412	382
9.	Raisen Tola	676	652	1.80	1.68	402	370	374	352
10.	Sultanpur	618	594	3.96	3.62	435	404	348	322
11.	Patha	642	624	1.56	1.42	316	388	416	392
12.	Marhati	465	446	3.19	2.52	438	408	388	364
13.	Patpari	526	508	1.70	1.62	376	348	328	304
14.	Magrandi	554	536	2.20	2.01	426	390	288	262
15.	Madhiya	462	438	2.04	1.82	382	358	314	292
16.	Parasia	572	542	1.84	1.72	452	416	362	338
17.	Devani	637	612	3.88	3.52	474	438	416	388
18.	Samnapur	562	544	1.42	1.28	402	377	232	216
19.	Pathpoudi	656	626	2.90	2.64	396	362	342	318
20.	Paheria	575	548	2.68	2.42	414	378	334	312









Discussion

Manganese inform of mineral naturally occurs in rocks and soil and may also be present due to underground pollution sources. Manganese is seldom found alone in water. It is frequently found in iron-bearing waters but is more rare than iron. Chemically it can be considered a close relative of iron since it occurs in much the same forms as iron. Manganese can be consumed from our diet and in our drinking water. Bathing and showering in manganese containing water does not increase our exposure since manganese does not penetrate the skin and doesn't get into the air. High exposure to manganese has been associated with toxicity[4,5] to the nervous system, producing a syndrome that resembles Parkinsonism[6]. Manganese is unlikely to produce other types of toxicity such as cancer or reproductive damage. Mn in drinking water is

associated with neurological damage. Manganese is a known mutagen. The accumulation of Mn may cause hepatic encephalopathy[7].

The presence of iron in ground water is a direct result of its natural existence in underground rock formations and precipitation, water that infiltrates through these formations. As the water moves through the rocks some of the iron dissolves and accumulates in aquifers which serve as a source for ground water. Since the earth's underground rock formations contain about 5% iron, it is common to find iron in many geographical areas around the globe. Iron in water is typically found in three major forms and is rarely found in concentrations greater than 10 milligrams per litre. 'Clear water iron' is a non-visible ferrous (Fe2+) form of dissolved iron[8] is found in water that is not exposed to oxygen, such as in wells and springs. 'Iron bacteria' – Dissolved iron contributes greatly to the growth of iron bacteria. These bacteria form dark-coloured slime layers on the inner walls of the system's pipes. In surface water, such as rivers and lakes, dissolved iron is hardly ever found, because it reacts with oxygen, forms insoluble compounds and sinks out of the water. However, in ground water such as wells and springs, iron is the most common dissolved chemical. Although not considered to cause health problems in humans, its presence in potable water is rather unpleasant due to the bad odours it spreads, its rusty taste and colour, its feel on skin and hair, and its tendency to stain clothing.

Iron is an essential nutrient for human[9], with a recommended daily intake of 5 milligrams. Therefore, the official water and environment agencies in many countries have established a secondary limit for iron in drinking water, which is based on aesthetic concerns.

Chromium is essential to animals and human. Chromium in excess amounts can be toxic especially the hexavalent form. Chromium is used to metal alloys and pigments for paints, cement, paper, rubber, and other materials. In dissolved form chromium is present as either trivalent $Cr(OH)_3$ or as hexavalent CrO_4^{2-}. The amount of dissolved Cr^{3+} ions is relatively low, because these form stable complexes. Oxidation ranks from Cr(III) to Cr(VI). In natural waters trivalent chromium is most abundant. Many chromium compounds are relatively water insoluble. Chromium (III) compounds are water insoluble, because these are largely bound to floating particles in water. Chromium (III) oxide and chromium (III) hydroxide are the only water soluble compounds. The main chromium mineral is chromite. As was mentioned earlier, chromium compounds can be found in waters only in trace amounts. Chromium (Cr) is an essential micronutrient for animals and plants. It is considered as a relative biological and pollution significance element. Chromium is an essential nutrient in man because it helps the body in the use of sugar, protein and fats but at low concentration. However, intake excess causes various health effects such as skin rashes, stomach upset, ulcer, respiratory problems, alteration of genetic materials, weakness of immune system, kidney and liver damage, and can even lead to death[10].

Total hardness (TH) is caused primarily by the presence of cations such as calcium and magnesium and anions such as carbonate, bicarbonate, chloride and sulphate in water. Water hardness has no known adverse effects; however, some evidence indicates its role in heart diseases and hardness of 150-300 mg/l and above may cause kidney problems and kidney stone formation, as it causes unpleasant taste and reduce ability of soap to produce lather. Hard water is unsuitable for domestic use.

Chloride (Cl) is a widely distributed element in all types of rocks in one or the other form. Therefore, its concentration is high in groundwater. Mostly, the chlorides are found in the form of sodium chloride in the groundwater. Soil porosity and permeability also has a key role in building up the chloride concentration. Although, the chloride plays an important role in balancing level of electrolyte in blood plasma, but higher concentration can produce some physical disorders. In this study area few areas has higher concentration, which could be dangerous from health point of view.

The sulphate (SO_4^{2-}) ion is one of the important anion present in natural water produce catharsis, dehydration and gastrointestinal irritation effect upon human beings when it is present in excess of 150 mg/l. It is mainly derived from gypsum on oxidation of pyrites. The sulphide minerals add the soluble sulphate into the groundwater through oxidation process.

One of the main trace elements in groundwater is fluoride (F) which generally occurs as a natural constituent. Bedrock containing fluoride minerals is generally responsible for high concentration of this ion in groundwater. Fluoride normally accumulates in the bones, teeth and other calcified tissues of the human body. Excess of fluoride in water causes serious damage to the teeth and bones of the human body, which shows the symptoms of disintegration and decay[11], diseases called dental fluorosis[14] and skeletal fluorosis.

The higher intake of fluoride may change the metabolic activities of soft tissues (brain[13], liver, kidney, thyroid and

reproductive organs). The permissible limit of fluoride in drinking water is 1.5 mg/l. water containing more than 1.5 mg/l of fluoride cause mottled tooth enamel in children and are not suitable for drinking purpose. Excess fluoride may also lead to fluorosis that can result in skeletal damage[15]. Clinical report indicate that adequate calcium intake is directly associated with reduced a risk of dental fluorosis. Vitamin C also safeguards[12] against the risk.

Conclusion

The result of this study shows that the monitored physico chemical parameter of the potable water is quite improved just after monsoon due to good rain fall. The concentration of manganese, iron & chromium in 50% villages are showing upward trend. Although these ions are essential for metabolism but its higher concentration than permissible limit (of both WHO[17] (2004) and BIS[16] (1993)) poses harmful effect to human health. It is recommended that potable water sources should be routinely monitored Economic use of water should be advised and rechargement should be done carefully and seriously. In many parts ground water is being withdrawn above the capacity of rain to recharge the acquifers, even with manual intervention. Then inspite of heavy rainfall, the quality of the water would be degraded.

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